

**PRIVATE SECTOR LAND MARKET DECISION AGENTS
AS TARGETS OF FLOOD PLAIN POLICY***

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This article examines the influence of floodplain land use policy on land market decisions of three private sector decision makers--owners of vacant land, developers, and building owners. It is based on a mail survey of 312 such decision makers in 10 cities across the United States. Our findings imply that floodplain programs, with their emphasis on floodproofing, have a significant effect on the extent to which new structures built in the floodplain are protected from future flood damage, but less effect on decisions to buy vacant land, develop property, or occupy structures in floodplains in the first place. The findings also imply that effective floodplain programs must target builders and developers and owners of vacant land because their decisions come earlier in the rural-to-urban land conversion process and they are more likely to avoid the hazard or take mitigation actions in response to information, incentives and regulations. Nevertheless, policy should also target the consumer, emphasizing insurance and awareness of the risks of flood damage, something that current policy does not do adequately.

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Year in and year out, flooding causes greater property losses, worldwide, than any other natural hazard. To cope with that problem, governments have invested millions of dollars in flood control and disaster assistance. To reduce those public expenditures, policy has shifted since the late 1960s in the United States from flood control structures and disaster relief to greater reliance on floodplain land use and construction requirements in conjunction with flood insurance. In 1968, the federal government adopted the National Flood Insurance Program (NFIP), which requires local floodprone communities to adopt floodplain regulations in order to be eligible for federal disaster relief and for property owners in the community to be eligible for federal flood insurance. As a result, more than 17,000 communities across the U.S. have adopted floodplain management programs to reduce both the amount of urban development at risk from flooding and its susceptibility to damage. (For overall descriptions and assessments of U.S. floodplain policy see Burby and Kaiser 1987, and Burby et al. 1985.)

Although floodplain management programs originate in the public sector, whether they work depends on the response of the private sector. James et al. (1971, p. 5) suggest that even the term floodplain management is a misnomer, since it is not floodplains we must manage, but people. Other observers also have asserted that to comprehend how program impacts occur and vary from one place to another, we need to understand how programs affect decisions in the private sector (Allee and Walter 1977, p. 9; Whipple, Hufschmidt et al. 1976, p. 39). Public policies, in fact, often are implicitly or explicitly designed to modify private behavior. For example, actuarial flood insurance requirements and rate levels are supposed to encourage property owners, builders, and developers to consider adequately the risk of flood damage in the floodplain (Federal Emergency Management Agency 1986; Krutilla 1966).

The implicit theory underlying federal floodplain policy is that the NFIP will coerce local governments to adopt land use management policies in order to remain eligible for federal disaster aid in the event of a flood and to continue receiving federal grants for community facilities, and for its citizens to be eligible for flood insurance. The federal requirements are designed to encourage local jurisdictions to

tion or floodproofing of buildings that do get built in the floodplain, and encourage owners of new and existing developed property to insure themselves against the costs of flood damage. To accomplish that, the NFIP requires local governments to prohibit new development in the floodway that would result in any increase in flood levels within the community and require living areas of new buildings throughout the 100-year floodplain to be elevated to the predicted 100-year flood level. Owners of new buildings are also to be required to purchase flood insurance if they take out a federally insured mortgage, at least initially, although they may drop that insurance at a later time. Local government may also impose other site design and construction requirements and lower the allowable densities in the floodplain to reduce the amount of property at risk. Of course, in order to have an effect on the development of the floodplain, local government policy must influence predevelopment landowner decisions, developer and builder decisions, and consumer decisions, among others involved in the land conversion process (e.g., financiers, brokers and permitting authorities). Those altered private sector decisions then presumably affect the broader public welfare--reducing demand for public expenditures on flood control and disaster assistance, improving water quality, and not exacerbating flooding for other property. So goes the implicit policy theory.

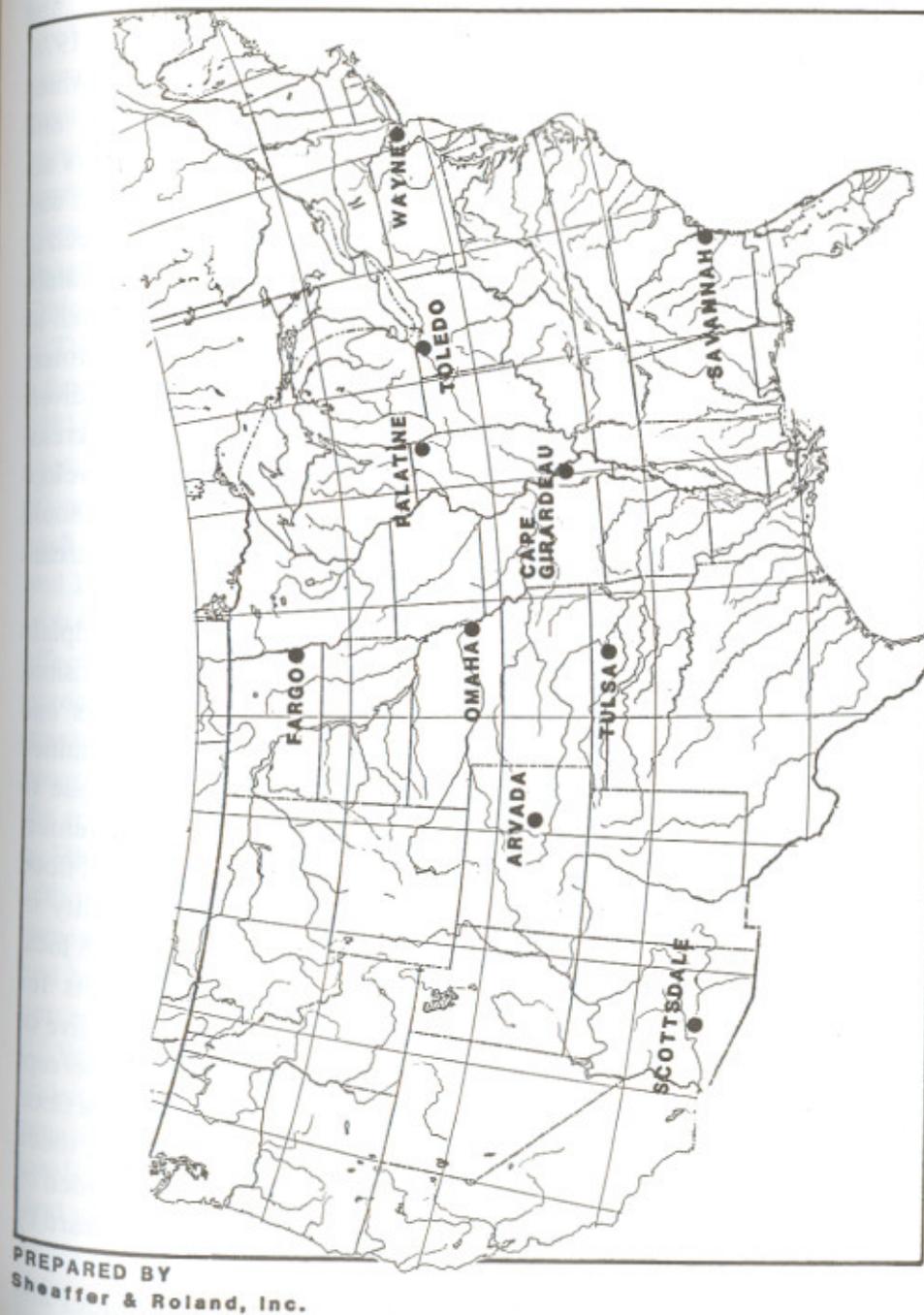
Previous research on private sector decision makers in floodplains has focused predominantly on occupants in the floodplain (Beyer 1967; Burton 1961; Cross 1985; Cypra 1973; James et al. 1971; Kates 1962; Kunreuther et al. 1978; Laska 1986; McPherson and Saarinen 1977; Roder 1961; White 1964). That research has focused on both people's choices to move to and remain in flood hazard areas, and their adjustments to the hazard, including the purchase of flood insurance.

By focusing on floodplain occupants, those previous studies have examined only the final stage in development of floodplains and have therefore limited the usefulness of such studies for policy makers in our judgment. This article therefore examines the floodplain land market decisions and attitudes of several particular private sector decision makers--owners of vacant land (who we term land owners in this study), developers (including builders), and residential and commercial building owners (who we term consumers). All three are important to the con-

The thesis of this article is that the three types of decision agents are affected in different ways and with varying effectiveness, and that all three are suitable targets of floodplain management. To be optimally effective, policy should persuade landowners to not expect intensive urban uses or corresponding high land values for their property; influence developers to either avoid floodplain land or to adopt site design and construction measures that reduce the risk of damage to whatever development they undertake in hazardous areas; and influence consumers to purchase and retain flood insurance and adopt measures to protect their property from flood damage.

PUBLIC POLICY AND PRIVATE SECTOR DECISION MAKERS IN THE CONVERSION OF FLOODPLAIN LAND FROM RURAL TO URBAN USE: A CONCEPTUAL FRAMEWORK

Figure 1 shows our conceptual model of the floodplain land conversion process that guided this research. Across the top, the figure shows the stages through which land parcels proceed in being converted from rural use to urban use. It also shows the key decisions and decision makers that move a parcel of land from one stage to the next (Kaiser and Weiss 1970). Finally it shows the multiple paths of influence for local floodplain policy through the various decision makers involved in each set of land transforming decisions. An early, potentially important point at which floodplain management programs could intervene to interrupt the land conversion process is prior to the active interest in floodplain sites for urban development (Brown et al. 1981; Kaiser et al. 1968). An effective floodplain program should reduce the proportion of landowners whose motives are capital appreciation (speculation) through later sale to developers, subdivision of the land themselves, or building for personal use. First, the programs could be designed to increase awareness of the flood hazard and the risk it poses, making the floodplain less desirable as a location for business or residence. Second, building elevation requirements could lead to buyer qualms about the attractiveness and resale potential of development in the floodplain and should add to the cost of construction. Third, local government can withhold public infrastructure from floodplains and use zoning to lower the per-



For developers and builders, further along in the land conversion process, three decisions are critical--location decisions, site design, and building construction (Goldberg 1974; Goldberg and Ulinder 1976; Kaiser 1968). The location decision is based on the degree to which floodplain parcels are perceived as developable, marketable, and profitable, compared to alternative sites. The developer considers access to employment, shopping, and amenities for the buyer and the cost of providing infrastructure to the site. For those projects that proceed in the floodplain, the site design and building construction decisions establish the degree to which site layout and structural measures--such as channel improvements, fill or elevation--are incorporated to protect buildings and their occupants from future flooding. Policy can divert development from the floodplain by reducing profits, either by increasing costs or reducing the marketability of the residences. For development that makes economic sense in the floodplain, regulations should result in greater protection from flooding and less impact on downstream development.

After building construction, the die is cast with respect to floodplain encroachment. Nevertheless, consumer purchase and rental decisions are important for several reasons. First, the success of developers' and builders' location, construction, and marketing decisions is determined by consumer decisions; developers and builders will not continue to build in the floodplain if their projects are not purchased or rented. Second, consumers' private mitigation actions and the purchase of flood insurance help determine physical and financial vulnerability of floodplain property. Thus, for consumers, as for developers, both locational decisions and mitigation decisions are logical targets for floodplain policy. Whether floodplain policy affects decisions to live or conduct business in the floodplain will depend on consumers' perceptions of the hazard and the relative weight they place on the risk of flood damage compared to attributes of the development that attract them. Once consumers locate in flood hazard areas, they can be persuaded by perception of danger and by floodplain policy to mitigate the hazard by floodproofing and purchasing insurance.

In the remainder of this article, we will examine the attitudes and decisions of these three groups of decision makers which affect the

METHODS

We assembled sample frames for each of the three decision makers--owners of vacant floodplain land, developers and builders in the community, and owners of homes and businesses in the floodplain--from tax records and other local sources during field visits to ten selected communities across the United States. The ten cities are Arvada, Colorado; Cape Girardeau, Missouri; Fargo, North Dakota; Omaha, Nebraska; Palatine, Illinois; Savannah, Georgia; Scottsdale, Arizona; Toledo, Ohio; Tulsa, Oklahoma; and Wayne Township, New Jersey. See Figure 2. The ten cities were selected from a list of 21 that were the subject of a floodplain land use management study in 1976 Shaeffer and Roland (1981). We then used a mail survey of a random sample of 30 owners of vacant land in each of the ten communities (unless there were fewer than 30 in which case we included all of them), 30 developers and builders in each community, and all the owners of property developed between 1976 and 1985 in the sample frame (181 in all, since there were communities with fewer than 30.) The questionnaire contained items focused on the effects of the flood hazard and floodplain management programs on land purchase and development decisions and decisions about protective measures, as well as attitudes toward the flood hazard, government programs, and real estate decision. The mail surveys were conducted in the spring of 1987 using a "total design" survey methodology perfected by Dillman (1978). After a postcard reminder and two follow-up letters with replacement questionnaires, we obtained 312 responses--101 from owners of vacant land (50 percent response rate), 106 from developers and builders (36 percent response rate), and 105 from consumers (58 percent response rate).

We merged survey data with information about each of the ten cities and its floodplain management program. We calculated an index of program strength by aggregating the strength of five components of the local floodplain management programs (construction requirements, land use measures such as density transfers, implementation effort, enforcement, and existence of a state mandate). Community context variables were also hypothesized to affect the ability of policy to influence land market decisions. Contextual variables include the amount of land

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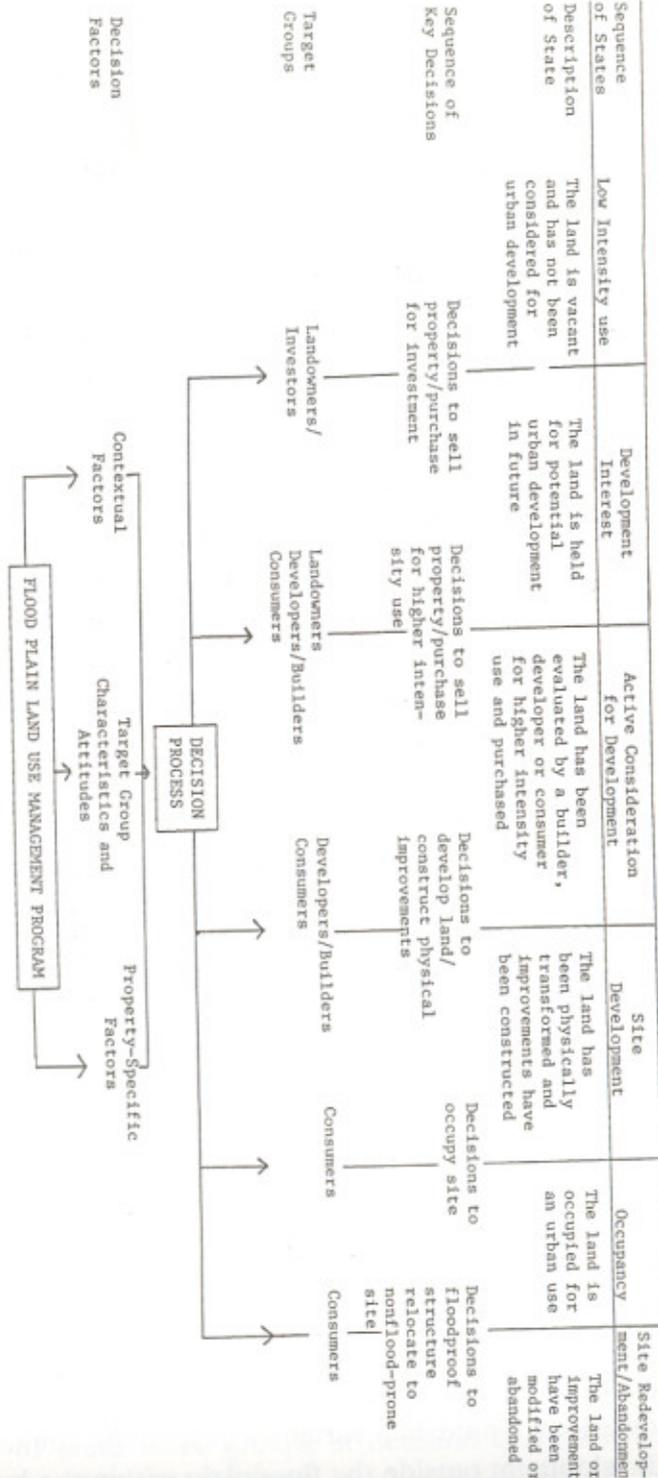
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(the more alternative sites outside the floodplain, the easier it is for policy to deflect development from the floodplain); the rate of growth in the community and the median price of housing (the higher the growth rate and the higher the median price of housing the easier it is for developers to pass along the costs of floodproofing and the less likely it is that policy will be able to divert development away from the hazard area); the political support for floodplain management by city officials, development interests, and citizen groups (the more support for the program, the more effective it should be); and the recency and frequency of past flooding during the study period (the more recent and frequent the experience with flooding, the easier it is for policy to discourage new development in the flood hazard area).

Analyses of the survey and related contextual data consisted of separate statistical analyses for each of the three decision agents, but with data pooled across the ten cities. Percentage tables and non-parametric statistics, particularly chi-square and the gamma measure of association, were used to examine relationships.

LANDOWNERS AS TARGETS OF FLOODPLAIN POLICY

An effective floodplain management program should reduce the proportion of land owners who purchase land for capital appreciation, subdivision, or building for personal use, or who are now holding land for those purposes regardless of original purpose of their purchase. Policy could do that by increasing the perception of flood risk and otherwise lowering expectations about future land value appreciation and suitability of the land for urban use.

Purposes Behind Purchases of Vacant Land

For the reasons stated earlier, we expect the proportion of parcels acquired for land value appreciation to drop after cities adopted strict elevation requirements. In fact, however, the proportion of properties purchased for capital appreciation or future subdivision did not drop after cities adopted such policies. Both before and after cities adopted elevation requirements, 38 percent of the sample parcels were purchased for appreciation or future subdivision.

Other factors, however, combined with the floodplain management program in some communities to produce an effect. In the three cities with the most "policy supportive" conditions--stronger political support, more developable land outside floodplain, and more frequent or more recent flooding during the 10-year period studied--land purchases for appreciation in value or for future subdivision did significantly decline after floodplain management programs were adopted. In those cities (Scottsdale, Toledo, and Tulsa), 11 percent of land purchases were for capital appreciation or subdivision after adoption of the floodplain program, compared to 28 percent prior to the existence of the floodplain program. This finding suggests that community context is an important factor in the ability of a floodplain program to decrease investment buying of vacant land in the floodplain.

Regardless of original motives for purchasing vacant property, the owners were less likely to be holding their land in 1987 for value appreciation or future subdivision if they purchased the land after the community adopted elevation requirements. See Table 1. Further, for land purchased after the community adopted floodplain regulations, the proportion of owners holding their land for appreciation or subdivision is reduced in communities with more flood free land available for development.

Table 1

INVESTMENT HOLDING OF FLOODPLAIN LAND BEFORE AND AFTER INITIATION OF FLOODPLAIN PROGRAM

	Parcel Acquired	
	Before Program	After Program
Holding Property for Investment Purposes	29%	7%
Holding Property for Other Reasons	71%	93%
	100%	100%
	(n=58)	(n=28)

Chi-square = 4.18

p = .04

n = 86

In contrast to property bought for speculation, floodplain policy did reduce the percentage of persons who initially bought vacant property intending to build and live on it themselves. Forty-one percent of parcels bought before floodplain program initiation were purchased by persons interested in living on the property, while 26 percent of parcels purchased after program initiation were bought for that reason. In addition, acquisition for residential use after floodplain program initiation was less in those cities with an expansive supply of developable land outside the floodplain. See Table 2.

Table 2

EFFECT OF AVAILABILITY OF FLOOD-FREE SITES ON PURCHASE FOR RESIDENTIAL USE FOR PROPERTIES ACQUIRED AFTER LOCAL FLOODPLAIN PROGRAM INITIATION

	Developable Land Outside Floodplain:	
	25+ Year Supply	Less than 25 Year Supply
Land bought for residential use	19%	38%
Land not bought for residential use	81%	62%
	100%	100%
	(n=16)	(n=16)

Chi-square = 2.58

p = .10

n = 32

Gamma = .44

Respondents interested in building for themselves claimed zoning was the most important factor in their acquisition decision. For those interested in speculation, accessibility was more important. Thus, market-oriented factors were more important than floodplain characteristics or floodplain regulations in land purchase decisions.

Property Value Expectations

Expectations of increases in property value play an important role in investment decisions.

tial use. In this section, we examine the effects of the flood hazard and the various elements of a floodplain program on land owners' expectations regarding the value of their property in five years. We believe an effective program would be one that diminishes expectation of gain from investment in floodplain land.

Property owners generally are optimistic about property value appreciation in the future although many are aware of a specific negative impact of the flood hazard and regulations on property value. Sixty-one percent of the property owners expect appreciation in value over the next five years; 28 percent expect that appreciation to be greater than 25 percent. However, 47 percent reported that the flood hazard and floodplain regulations specifically had caused substantial declines in their property value in the past (i.e., 25% decline and greater).

Landowners' expectations regarding appreciation in value appear to be reduced in direct proportion to the perceived probability of flooding in the future, as shown in Table 3. When the perceived flood threat is very severe, fewer landowners expect appreciation in land value and more of them expect the value of the property will decline in the future.

Table 3

ASSOCIATION OF PERCEIVED FLOOD THREAT WITH PROPERTY VALUE EXPECTATIONS OF THE OWNERS OF VACANT LAND

	Perceived Flood Threat		
	No Threat	Moderate	Very Severe
Value will increase	71%	65%	50%
Value will remain same	29%	35%	35%
Value will decrease	0%	0%	15%
	100%	100%	100%
	(n=21)	(n=42)	(n=20)

Percentages are of owners within each category of flood threat

Chi-square = 11.79

p = .05

n = 83

Gamma = .29

Two attributes related to a local floodplain management program--state mandate and amount of structural flood control expenditures--appear to influence the effect of floodplain policy on property value expectations. In cities with state-mandated programs, only 16 percent had high expectations (25 percent or greater) for land value appreciation compared to 37 percent in cities without such a mandate. Local government money spent on structural flood control measures such as levees, channel improvements, and dams over the last ten years, on the other hand, raises property appreciation expectations, as shown in Table 4. In cities that have spent more than \$5 million on flood control structures, 72 percent of property owners expect appreciation of their property value in the next five years versus 43 percent of the property owners in cities with less than \$5 million in structural expenditures.

Table 4

ASSOCIATION OF FLOOD CONTROL EXPENDITURES WITH LAND OWNERS' PROPERTY VALUE EXPECTATIONS

	Flood Control Expenditures	
	Less than \$5 Million	\$5 Million or more
<u>Land owner's expectation</u>		
Value will increase	43%	72%
Value will remain the same	49%	26%
Value will decrease	9%	2%
	101%	100%
	(n = 35)	(n = 53)

Percentages are of parcels within each expenditure category

Chi-square = 9.67

p = .02

n = 88

Gamma = .51

DEVELOPERS AND BUILDERS AS TARGETS FOR FLOODPLAIN POLICY

Builders and developers are well aware of the flood hazard, mitigat-

found out about flood potential prior to their land purchase decision. Eighty percent or more of the firms were familiar with each of nineteen flood hazard mitigation measures we asked about. Ninety-five percent of the firms were familiar with regulatory limitations on building in flood hazard areas, while 94 percent were familiar with the requirement that floodplain boundaries be marked on subdivision plats.

Flood problems are salient to builders and developers. Thirty-seven percent have owned property that has been flooded. One-half of the respondents had discussed flooding with business associates or friends in the past year. Also, 53 percent characterized the community flood threat in the sample city as "very severe" (15 percent) or "moderate" (38 percent). Only 3 percent of the firms characterized the city flood threat as non-existent.

Effect of Floodplain Management Programs on Location Decisions by Builders and Developers

To affect developers' and builders' location decisions, floodplain management programs must reduce their perceptions of the profitability and developability of the floodplain. Yet, local floodplain programs appear to have negligible influence on firms' evaluations of floodplain development opportunities and on their subsequent decisions to develop floodplain land. No significant differences existed in the percentage of firms involved in floodplain development between cities with strong and weak floodplain management programs (47 percent of firms in cities with weak programs have built in floodplain compared to 43 percent in cities with strong programs).

One reason stronger floodplain programs appear to have little effect may be because the stronger programs were in those sample cities where population growth and median housing value was greatest. See Table 5. Four of the five cities with the strongest programs are also the fastest growing--Arvada (80.7 percent growth in the 1970's), Scottsdale (30.4 percent), Palatine (24.2 percent), and Fargo (15.0 percent). Fifty percent of developers perceived floodplain land as profitable in those cities with strong programs, compared to 28 percent of developers in cities with weak programs. The increased perceived profitability of floodplain

residential and commercial demand rather than characteristics of the floodplain management program.

Table 5

ASSOCIATION OF FLOODPLAIN PROGRAM STRENGTH AND MEAN CITY GROWTH RATE AND MEDIAN HOUSING VALUE

	Strong Floodplain Program *	Weak Floodplain Program **
City growth rate 1970-1980	29%	4%
Median housing value 1980	\$75,600	\$38,400

* (strong = Palatine, Scottsdale, Fargo, Arvada, and Wayne)

** (weak = Omaha, Tulsa, Toledo, Cape Girardeau, Savannah)

The cities with the stronger programs also have the highest median housing values in the sample--Palatine (\$89,000), Wayne (\$86,000), Scottsdale (\$75,000), Arvada (\$72,000), and Fargo (\$56,000). Those higher housing values would provide a larger margin for firms to pass on the higher costs of building in floodplains to the consumer. Because of the strong demand for housing and marketability of housing products produced in those cities, builders and developers also encountered less resistance from lenders due to a project's floodplain location (18 percent encountered resistance) compared to lower-growth cities (27 percent encountered resistance).

The interaction effects of strong floodplain management programs in cities with strong real estate markets is apparent in two additional findings--builders are more likely to perceive floodplain development as growing in such cities than in cities with weaker programs (61 percent vs. 37 percent), and floodplain property is more likely to be perceived as expensive in fast growing cities than in slower growing cities (57 percent vs. 47 percent).

Another important factor influencing builders' and developers' evaluation of floodplain land as expensive is the relative scarcity of flood-free sites. In cities with limited development opportunities outside the

floodplain, 61 percent of firms evaluated floodplain land as expensive compared to only 38 percent in cities with a 25 year or greater supply of developable flood-free sites.

Mitigation Efforts

While they have little effect on developers' and builders' decisions to locate new development in flood hazard areas, strong floodplain management programs do lead to flood protection adjustments. In the sample cities with stronger programs, floodplain development was protected by more hazard mitigation measures than in cities with weaker programs. Fully 77 percent of firms developing in cities with strong floodplain management programs were incorporating three or more mitigation measures into the site design and building construction of floodplain projects, compared to 57 percent of firms building in cities with weaker floodplain programs. The mitigation techniques most commonly adopted by developers involve adding fill to raise property elevation, elevating individual buildings, designing streets and lot layout to minimize the need for fill, and waterproofing structure walls. Developers claim that, on average, costs of mitigation add between 5 and 9 percent to total project costs. Cities with stronger programs also have higher housing values, so the higher prices may allow developers in those cities to pass on the costs of protective measures.

OWNERS OF DEVELOPED PROPERTY AS TARGETS OF FLOODPLAIN POLICY

Given that the land conversion process has progressed to the point where builders and developers have produced a product ready to be occupied, what influence does local floodplain policy exert on consumer decisions? Relevant target decisions include whether to purchase a house or other building in the flood hazard area, whether to install protective measures, and whether to purchase flood insurance. Ironically, owners of developed property—who can be more directly and personally affected by flood damage than the two groups discussed earlier—are less amenable to being influenced by floodplain management policy.

The Purchase Decision for Already Developed Property

Our findings indicate that buyers of developed property in the floodplain think that appearance, layout, and space in the dwelling and the trees, spaciousness, and the views often associated with floodplain sites are the most important characteristics affecting their purchase decision. Those factors are more important than accessibility, financing, and neighborhood socio-economic status.

It is not that most property owners did not know about the property being subject to flooding. Sixty-five percent of the persons owning developed property investigated whether it was subject to flooding prior to acquisition and knew about it before purchasing the property. That percentage is higher than found for persons owning vacant land (37 percent) but lower than the percentage of developers (90 percent). Knowledge of potential flooding was of little concern to most buyers, however; only 13 percent of them reduced their offering price due to the possibility of flooding. Thus, the perceived advantages of floodplain location (in particular, physical attractiveness of floodplain sites) seems to overshadow the negative aspects of potential flooding for many buyers, a finding consistent with James et al. (1971).

Publicly constructed, off-site flood protection measures such as dams, small watershed projects, dikes or levees, or channel improvements, also increase consumer acceptance of floodplain locations. The findings seem to indicate that such investments increase the property value expectations of floodplain property buyers. In cities with substantial flood control expenditures, 40 percent of the consumers had expectations of property value increases of 25 percent or more over the next five years, compared to only 21 percent of respondents in cities with less substantial flood control investments. That finding is consistent with what was found for purchasers of vacant floodplain land and points to the conflict between flood control measures and land use measures. Structural flood control measures increase the perceived investment potential of floodplain property while land use measures seek to decrease perceptions of investment potential. In other words, while protecting existing property, flood control investments increase the attractiveness of floodplains for future development.

Post-Construction Mitigation Measures

Given occupancy of the floodplain, local governments might still try to stimulate on-site mitigation action by floodplain residents. In fact, however, we found that only 16 percent of consumers had invested in on-site mitigation.

Owners who buy developed property in the floodplain appear to be more difficult than developers for government to motivate to take individual on-site mitigative action, for two reasons. For one thing, property owners tend to have less actual experience with flooding and are less perceptive of the risk than builders and developers or owners of vacant land. The main reason given by property owners for not spending money to mitigate flood damage was that there was "no need for it--flooding not a problem" (65 percent). That is unfortunate because we also found that awareness and concern are associated with mitigation action, suggesting that if policy were able to alert consumers to the risk and cause them to be more concerned about it, they might be more likely to adopt mitigation measures. See Table 6. As shown in that table, 25 percent of the 53 property owners who were aware that their property was in a flood hazard area took mitigation actions compared to 6 percent of the 49 who were not aware. Thirty-one percent of the 16 consumers who were "very" or "fairly" concerned about the flood hazard took action compared to 12 percent of the 86 who were "very little" or "not at all" concerned. Thirty-eight percent of the 13 consumers with actual personal experience with

Table 6

EFFECTS OF FLOOD HAZARD AWARENESS, CONCERN AND EXPERIENCE ON LIKELIHOOD OF CONSUMERS TAKING MITIGATION ACTION (Figures indicate percent taking mitigation action)

	YES	NO
Aware that property is in flood hazard area	25%	6%
Very or fairly concerned about the flood hazard	31%	12%
Actual personal exper-	38%	10%

flooding took mitigation actions compared with only 9 percent of the 88 without such personal experience.

The second obstacle making it difficult to persuade consumers to invest in mitigation actions is the feeling by three out of four consumers that the potential for flooding has no adverse effects on present property values or the rate of increase in property values in the future. See Table 7.

Table 7

PERCEIVED EFFECT^a OF HAZARD AND FLOOD PLAIN REGULATIONS ON PROPERTY VALUE FOR OWNERS OF DEVELOPED AND VACANT LAND

	Percentage of Owners of:	
	Developed Property	Vacant Land
No Perceived Effect	74%	37%
0-9% Loss	9%	6%
10-24% Loss	9%	10%
25% Loss and Greater	7%	47%
	99%	100%
	(n = 55)	(n = 60)

a Difference in value of property over what it would be worth if it were not located in a regulated flood hazard area.

Chi-square = 23.07
p = .01
n = 115

Flood Insurance

More owners of developed property carry flood insurance (26 percent) than employ mitigation measures (16 percent), but that also is not a very high proportion. Another 21 percent had carried insurance in the past, but they dropped it. Fifty-three percent of the respondents had never purchased flood insurance. The...

not having insurance against flood damage was that insurance was "not worth it, flood risk too low." Boggs (1986), in a study of eighteen cities in the Tennessee Valley, found an even lower insurance adoption rate (17 percent). Nationally, roughly 29 percent of the approximately 7 million flood prone structures are insured (Burby and Kaiser 1987).

The perceived seriousness of the flood problem is also important in motivating insurance adoption. Thirty-six percent of owners who perceive the problem as extremely or moderately serious carried insurance, compared to 25 percent of owners who characterized the flood problem as slight or non-existent. The strength of the relationship between perceived seriousness of flood problem and flood insurance found here, however, is not as strong as that found by Kunreuther et al. (1978).

POLICY IMPLICATIONS

We began with the argument that although floodplain management policy originates in the public sector, it must influence private sector behavior in order to be effective. The analysis of 312 private sector decision makers led that floodplain policy influences land owners, developers and builders, and consumers in different ways and with varying degrees of effectiveness. In this section, we summarize the implications of those findings with respect to three major goals of floodplain policy--decreasing future floodplain development, increasing the use of protective measures in whatever floodplain development is allowed to occur, and increasing the proportion of property owners who purchase flood insurance.

Decreasing Future Floodplain Development

All in all, floodplain programs seem to have mixed success in discouraging private sector decision makers from locating in the floodplain. On the one hand, the presence of floodplain programs did discourage purchase of vacant floodplain land for a future personal residence and reduced the proportion of owners currently holding land for speculative purposes. On the other hand, however, public policy did not decrease the attractiveness of the floodplain for builders and developers or for enough consumers to cause developers' projects to fail.

Builders and developers frequently undertake marketing studies to estimate the profitability of a proposed project. Development and building would not occur if consumer demand was insufficient, and consumer demand for floodplain development met builder expectations in our sample over 90 percent of the time. Our survey of consumers confirmed developers' impressions of consumer demand. Findings showed that consumers put more weight on such factors as the physical attractiveness of a floodplain site and the characteristics of the house than they placed on the risk of flooding. Thus, subdivision occurs in the floodplain, consumers will purchase the property and floodplain encroachment and habitation will occur.

Floodplain policy had less effect on the decision to purchase vacant floodplain land for investment and personal residence if flood free sites were scarce than when such alternatives were plentiful. Similarly, where there are fewer alternative flood free sites, and where there is strong population growth and high median prices for housing, local floodplain programs are even less effective in dissuading developers from building in floodplains. In strong development markets, the added costs of development attributable to floodplain regulations were found not to dissuade developers from building in the flood hazard areas of fast growing cities because in such circumstances they could pass added costs along to the consumer. That poses a bit of a dilemma; strong population growth, which stimulates the adoption of a strong floodplain management program in the first place, also tends to work against local programs' attempts to minimize encroachment once the program is initiated (Burby and French 1981).

Related public policy also affects the ability of floodplain regulations to divert new development from the floodplain. In particular, publicly constructed flood control works lead to heightened property value expectations on the part of land owners and increased purchasing of land for speculation or future subdivision. Thus, another dilemma results; the flood control works protect existing development, but encourage new development, thereby increasing the property at risk. Keeping roads, water and sewer, and other infrastructure away from the floodplain, of course, will complement floodplain policy by discouraging encroachment on the floodplain.

Increasing the Use of Protective Measures

While having relatively little effect on floodplain encroachment, stronger floodplain policies did significantly increase the degree to which builders and developers incorporated mitigation measures in the design of their projects. That is true even in strong market areas. Thus, the floodplain development that does occur where there are strong floodplain management programs is more adequately protected through on-site mitigation, in faster growing cities, than development in cities with weaker Programs. Consumers, however, are reluctant to invest in mitigation measures to protect their property except, possibly, after they have experienced flood damages (Laska 1986). Thus, floodplain programs should focus on builders and developers before flood events, but they should be prepared to help consumers retrofit their property to avoid future damages after flooding actually occurs.

Increasing the Proportion of Property Owners Protected by Flood Insurance

Most consumers do not carry flood insurance. Perhaps, that shouldn't be too surprising, since consumers have not been the direct targets of floodplain policy and insurance has not been a high priority goal. Nevertheless, stricter requirements for purchasing insurance at the time of real estate transactions and required maintenance of the insurance through at least the period of the mortgage could reorient that aspect of floodplain management policy. Stronger programs of education about the flood hazard would also help because consumers who are more concerned are more likely to be carrying flood insurance.

In summary, floodplain programs seem to have relatively little influence on private decisions to develop or not develop the floodplain, or to locate or not locate in the floodplain; and, they are relatively ineffective in persuading a substantial proportion of floodplain property owners to insure themselves against flood damage. The most successful aspect of floodplain management is the increase in the proportion of new floodplain structures that are protected from flood damage; of course, that is what the U.S. national flood insurance program actually em-

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